IMP (Gas and Liquid) Program and Implementation Lessons Learned

Jim Hotinger, Phil Sadler, Jim Fisher

Agenda

- 192/195 Notices/ADBs/NPRMs Update
- AC Corrosion and Interference
- Gas TIMP Inspection Lessons Learned
- IMP Data Integration, Threat Identification and Risk Models
- Q and A

ADBs October 2012 to Present

- ADB 2012-09 – Communications during emergency situations
- ADB 2012-10 – Using Meaningful Metrics in Conducting Integrity Management Program Evaluations
- ADB 2012-11 – Reporting of Exceedences of Maximum Allowable Operating Pressure
- ADB 2013-01 - Notice of Minimum Annual Percentage Rate for Random Drug Testing

ADBs Continued

- ADB 2013-02 - Potential for Damage to Pipeline Facilities Caused by Severe Flooding
- ADB 2013-04 - Recall of Leak Repair Clamps due to Defective Seal

2013 NPRMS

- August 1, 2013 - Public comment on applying Class locations and IMP requirements beyond HCAs
  - Add class locations
  - Eliminate class locations and design factors
  - Testing of transmission pipelines
  - Repairs of transmission pipeline
- August 16, 2013 – Miscellaneous amendments

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AC Corrosion and Interference

Phil Sadler

AC Current on Steel Pipelines

Personnel Hazard & Interference Corrosion

- Probably not an issue with galvanic anodes
  - Grounding provided
- Interference with impressed current cathodic protection
  - Need to ground for AC without disrupting CP

NACE International
Publication 35110

Predicting AC Corrosion

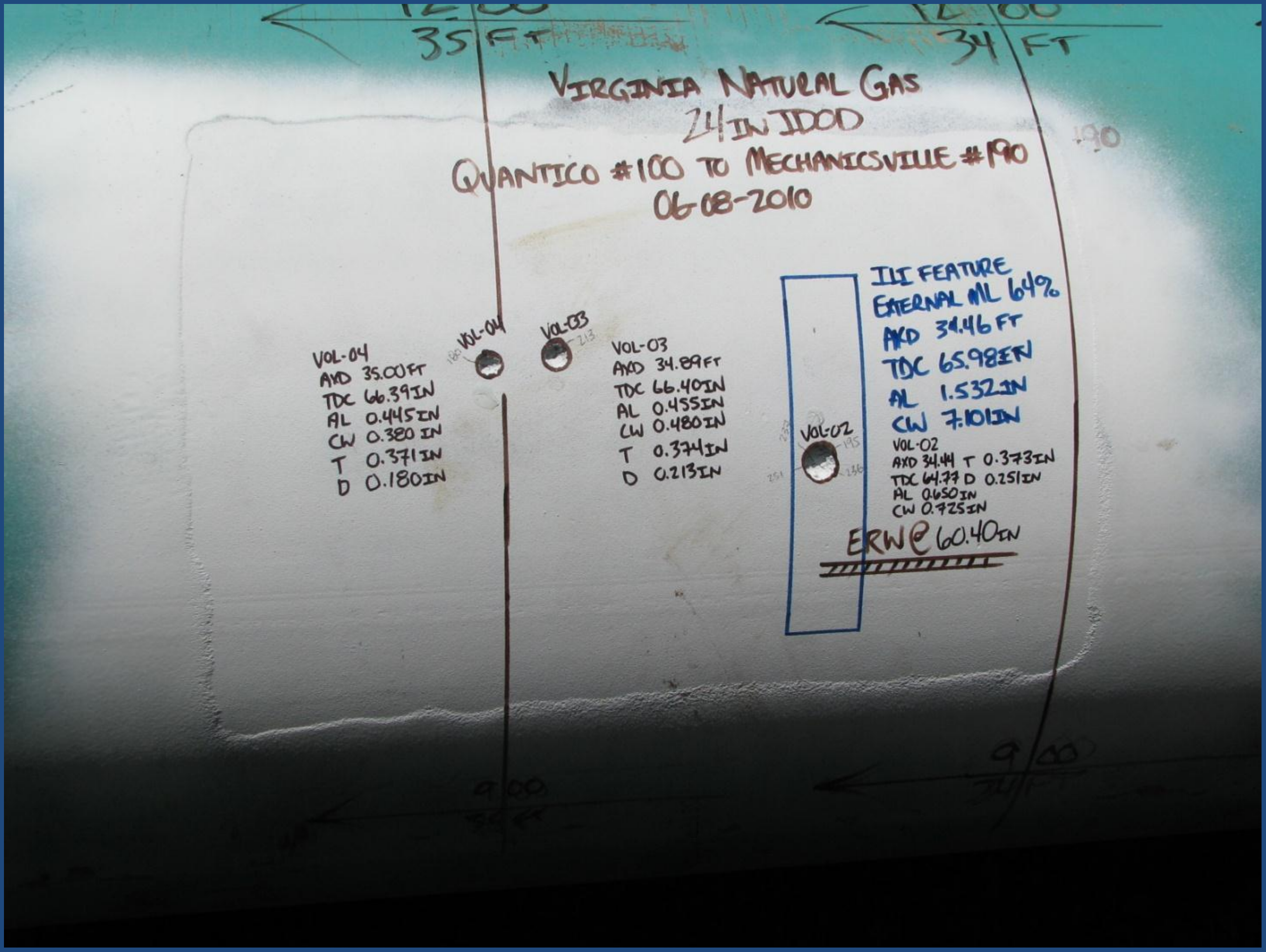
- Current density lower than 30 A/m2 (2.8 A/ft2): no or low likelihood;
- Current density between 30 and 100 A/m2 (2.8 and 9.3 A/ft2): medium likelihood; and
- Current density higher than 100 A/m2 (9.3 A/ft2): very high likelihood.

Current Density

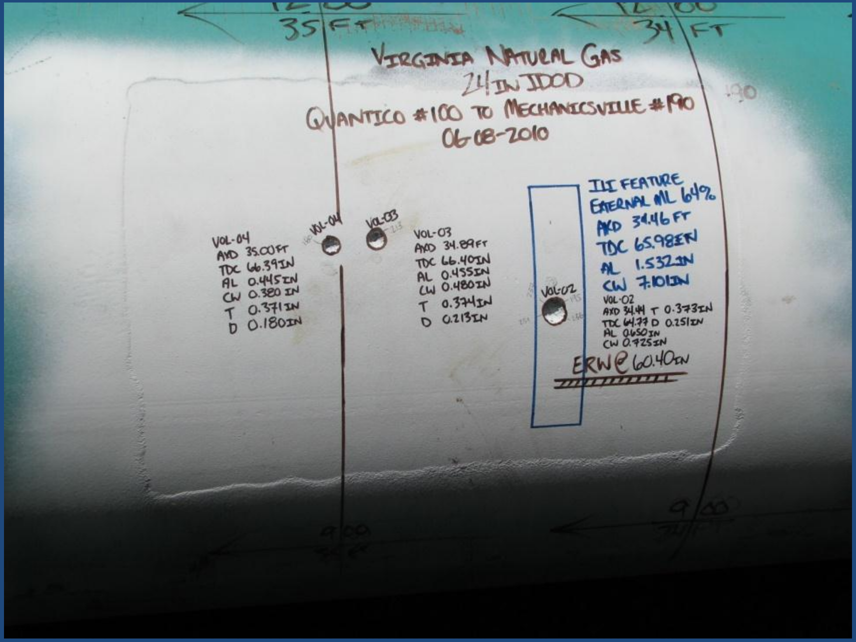
$$Iac = \frac{8 \times Vac}{\rho \times \pi \times d}$$

$$Iac = AC\ current\ density\ in\ A/m^2$$
$$\rho = soil\ resistivity, in\ ohm - meters$$
$$d = holiday\ diameter, in\ meters$$

AC Corrosion



AC Corrosion



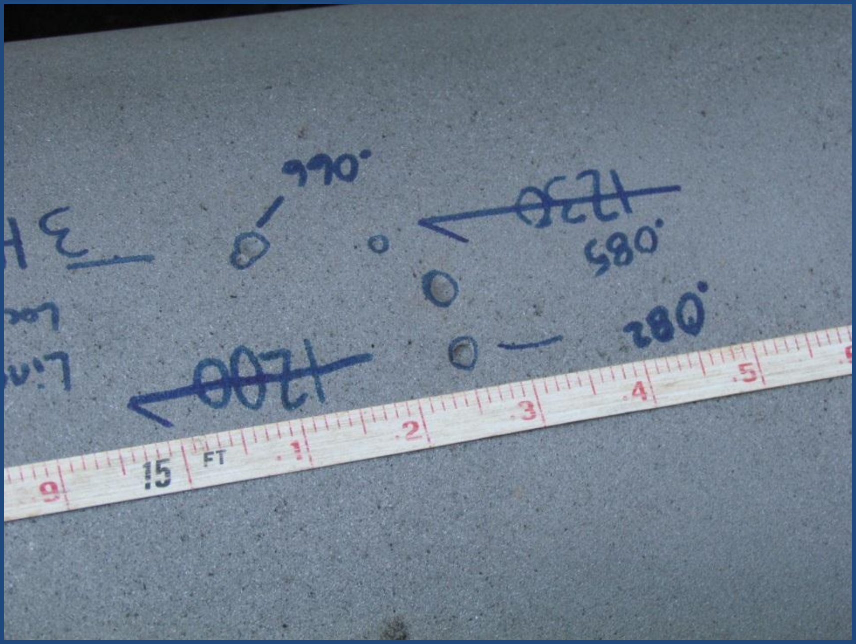
AC Corrosion

- Corrosion Product
- MFL Tool Results
  - Depth Under Call?

Low AC Voltage but Low Resistivity

- NACE states that the personnel hazard threshold is 15 Volts
  - It appears this is not unusual
  - Construction made difficult – grounding required
- Perhaps the threshold for corrosion is lower than 15 Volts
  - Low soil resistivity can influence current density

Interference Corrosion has a Similar Appearance to AC Corrosion



AC Mitigation

- Three Operators have Installed AC Mitigation or Plan to Do So.
- Is It Working?
- How Should It Be Monitored?

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Gas TIMP Inspection Lessons Learned

Generic Plans

- Many companies purchased plans. "Canned" sections are often not properly edited so that the plans fail to reference the company by name, and instead utilize general terms like "the operator may consider".
- Plans need to be company specific, addressing the unique details of your system. It is hard to convey these details when large sections of the plan utilize this general language.

PIR Calculations Referenced Code & Protocol

- **A.02.a.** Verify that the operator's formula for calculation of the potential impact radius is consistent with §192.903 requirements ($r = 0.69*(p*d^2)^{0.5}$) and that the pressure used in the formula is based on maximum allowable operating pressure (MAOP).
  - For gases other than natural gas, verify that the operator has documented processes for the use of ASME B31.8S-2004, Section 3.2 to calculate the impact radius formula [§192.903 Potential Impact Radius, §192.905(a)]

PIR Calculations

- In the plans reviewed, we have seen the following:
  - Incorrect PIR calculations.
  - Failing to consider the appropriate coefficient for your system:
    - 0.69 is used for natural gas – but what about "rich gas" or "mixed" gas systems?
    - Answer: Reference ASME/ANSI B31.8S Section 3.2 for equation below to calculate appropriate coefficient based on your systems composition.

$$r = 0.69 \cdot d\sqrt{p}$$

$$r = \sqrt{\frac{115{,}920}{8} \cdot \mu \cdot \chi_g \cdot \lambda \cdot C_d \cdot H_C \cdot \frac{Q}{a_o} \cdot \frac{pd^2}{I_{th}}}$$

Interactive Threats Referenced Code & Protocol

- §192.917(a) - Threat identification. An operator must identify and evaluate all potential threats to each covered pipeline segment. Potential threats that an operator must consider include, but are not limited to, the threats listed in ASME/ANSI B31.8S (incorporated by reference, see §192.7), section 2…
- **C.01.c.** Verify that the operator's threat identification has considered interactive threats from different categories (e.g., manufacturing defects activated by pressure cycling, corrosion accelerated by third party or outside force damage) [ASME B31.8S-2004, Section 2.2].

Interactive Threats

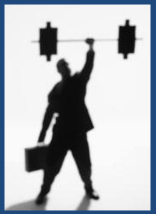
- In the threat ID process, ASME/ANSI 31.8S-2004 Section 2.2 states "The interactive nature of threats (i.e., more than one threat occurring on a section of pipeline at the same time) shall also be considered. An example of such an interaction is corrosion at a location that also has third party damage."
- Companies are tending to either omit this requirement from the plan, or fail to lay out how they will accomplish this requirement in their threat identification process.

Remaining Strength vs. Remaining Life Referenced Code & Protocol

- §192.933(d)(1)(i) …Suitable remaining strength calculation methods include, ASME/ANSI B31G; RSTRENG; or an alternative equivalent method of remaining strength calculation.
- **D.04.b.** Verify that the operator determines the remaining strength at locations where corrosion defects are found. Any corrosion defects discovered during direct examinations must be remediated in accordance with §192.933. [§192.925(b)(3)(ii), §192.933, and NACE RP0502-2002, Section 5.5]

Remaining Strength vs. Remaining Life

- While they are correlated, plans need to recognize that these are two discreet terms and calculations.
  – Remaining Life is calculated in the ECDA process to determine appropriate reassessment intervals (NACE RP 0502-2008 Section 6.2). It makes use of remaining strength values in its calculation.



- Plans have lacked details regarding how remaining strength will be calculated – will you use RSTRENG, ASTM B31.8G, DNV RP F-101, or an alternative equivalent method?

Quality Control Monitoring Referenced Code & Protocol

- §192.911(l) - A quality assurance process as outlined in ASME/ANSI B31.8S, section 12.
- **L.01.c.** Verify that corrective actions to improve the integrity management program and the quality assurance process have been documented and are monitored for effectiveness. [ASME B31.8S-2004, Section 12.2(b)(7)]

Quality Control Monitoring

- Quality control relative to IMP is defined as “documented proof that the operator meets all the requirements of their integrity management program.”
- One important activity in the QC process is “corrective actions to improve the integrity management program or quality plan **shall be documented and the effectiveness of their implementation monitored.”**
- Thus far, operators have either failed to adequately document these corrective actions, or failed to sufficiently monitor the effectiveness of the implemented corrective actions.

Internal Communication Plans Referenced Code & Protocol

- §192.911(m) - A communication plan that includes the elements of ASME/ANSI B31.8S, section 10, and that includes procedures for addressing safety concerns…
- **M.01.b.** Verify provisions for operator internal organizational communication exist to establish understanding of and support for the integrity management program. [ASME B31.8S-2004, Section 10.3]

Internal Communication Plans

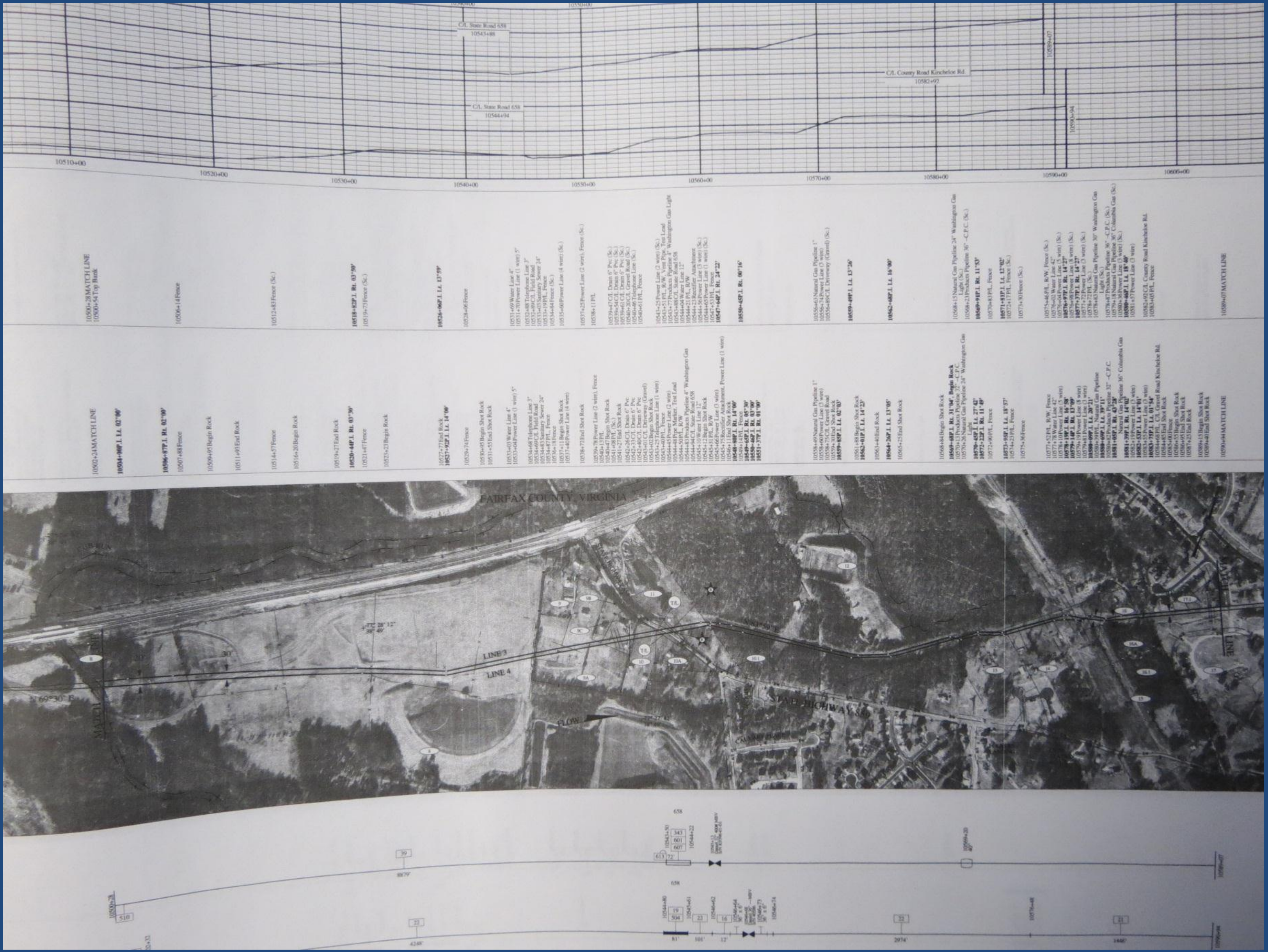
- Operator management and IM personnel must **understand** and **support** the IM program (ASME B31.8S-2004 Section 10.3).
  - This should be done through a written internal communications plan.
  - Plans reviewed thus far have lacked written provisions for internal communications. Most companies are accomplishing this through periodic meetings, but this should be a documented process.

Encroachment Referenced Code & Protocol

- 192.917 (e)(1) - Third party damage.

- …If, in conducting a baseline assessment under §192.921, or a reassessment under §192.937, an operator uses an internal inspection tool or external corrosion direct assessment, the operator must integrate data from these assessments with data related to any encroachment or foreign line crossing on the covered segment, to define where potential indications of third party damage may exist in the covered segment.

Encroachments



Encroachments

D-338.5 SHT 1

STATION	TYPE	COVER	CHNG. DIAG. NO.
415+57	10" N.G. PIPELINE, COMMONWEALTH	4.2'	UNKNOWN
420+23	16" SEWER LINE, COUNTY	5.2'	UNKNOWN
423+28	TELE. CABLE, C & P	1.0'	UNKNOWN
423+34	ELECTRICAL CABLES, V.P.C.	2.1'	UNKNOWN
423+64	3/4" WATER LINE, PRIVATE	2.0'+/-	UNKNOWN
423+81	ELECTRICAL CABLE, V.P.C.	2.0'	UNKNOWN
423+92	3/4" WATER LINE, PRIVATE	2.5'	UNKNOWN
4[illegible]4+03	TELE. CABLE, C & P	1.0'	UNKNOWN
4[illegible]+62	3" STEEL TELE. CONDUIT, BELL ATLANTIC	2.0'	A-18A-96-1
439+08	6" STEEL CASING, VEPCO	1.7'	A-18A-96-2
439+53	6" STEEL CONDUIT, COMMONWEALTH	2.0'	A-18A-95-3
440+40	15" SEWER LINE, COUNTY	11.0'	A-18A-90-5
440+58	15" WATER LINE, COUNTY	8.7'	A-1[illegible]-90-6
445+52	16" WATER LINE, COUNTY	4.5'	A-18A-90-3
446+31	14" WATER LINE, COUNTY	3.6'	UNKNOWN
446+47	16" WATER LINE, COUNTY	5.0'	A-18A-90-4
449+02	1/2" WATER LINE, PRIVATE	1.0'	UNKNOWN
449+21	1/2" WATER LINE, PRIVATE	1.0'	UNKNOWN
451+18	ELECTRICAL CABLE, PRIVATE	1.0'	UNKNOWN
453+46	8" SEWER LINE, COUNTY	8.7'	UNKNOWN
460+27	12" WATER LINE, COUNTY	3.7'	UNKNOWN
460+65	8"PRODUCTS PIPELINE, PLANTATION	3.4'	UNKNOWN
478+86	6" SEWER LINE, COUNTY	6.0'+/-	UNKNOWN
[illegible]2+65	1" TELE. CABLE, BELL ATLANTIC	1.7'	A-18A-97-2
482+75	4" TELE. CONDUIT, C & P	3.4'	UNKNOWN
482+89	3-4" ELECTRICAL CONDUIT, V.P.C.	2.0'+/-	UNKNOWN
487+25	8" SEWER LINE, COUNTY	7.0'	UNKNOWN
489+18	6" SEWER LINE, COUNTY	6.3'	UNKNOWN
489+30	TELE. CABLE, C & P	2.5'	UNKNOWN
489+37	2" WATER LINE, COUNTY	3.0'	UNKNOWN
489+69	2" WATER LINE, COUNTY	3.0'	UNKNOWN
489+75	2-ELECTRICAL CABLES, V.P.C.	1.5'	UNKNOWN
489+83	ELECTRICAL CABLE, V.P.C.	2.1'	UNKNOWN
489+90	6" SEWER LINE, COUNTY	5.7'	UNKNOWN
490+27	3-1" WATER LINES, COUNTY	2.1'	UNKNOWN
490+43	2-TELE. CABLES, C & P	2.7'	UNKNOWN
490+63	TELE. CABLE, C & P	1.0'	UNKNOWN
490+64	ELECTRICAL CABLE, V.P.C.	2.3'	UNKNOWN
492+64	2" N.G. LINE, CITY OF RICHMOND	4.4'	UNKNOWN
492+81	6-2" TELE. CONDUIT, C & P	7.2'	UNKNOWN
493+18	10" WATER LINE, CITY OF RICHMOND	4.2'	UNKNOWN
493+36	4" N.G. PIPELINE, CITY OF RICHMOND	4.6'	UNKNOWN
493+76	8" PRODUCTS PIPELINE, PLANTATION	7.7'	UNKNOWN
496+45	16" WATER LINE, COUNTY	8.1'	A-18A-92-1

D-338.6 SHT 1

STATION	TYPE	COVER	CHNG. DIAG. NO.
500+73	8" WATER LINE	UNKNOWN	UNKNOWN
502+05	2" WATER LINE, M.C.C.	1.5'	UNKNOWN
502+35	4" DRAIN LINE, M.C.C.	1.0'	UNKNOWN
502+68	4" DRAIN LINE, M.C.C.	1.0'	UNKNOWN
503+09	2" WATER LINE, M.C.C.	1.5'	UNKNOWN
503+36	4-1/4" WATER LINES, M.C.C.	1.5'	UNKNOWN
506+19	TELE. CABLE, C & P	1.7'	UNKNOWN
508+20	8" N.G. PIPELINE, CITY OF RICHMOND	4.0'	UNKNOWN
508+64	4" TELE. CONDUIT, C &P	UNKNOWN	UNKNOWN
515+60	4-4" SEWER TILE DRAINS, PRIVATE	2.0'	UNKNOWN
533+34	16" PRODUCTS PIPELINE, COLONIAL	4.9'	UNKNOWN
533+86	10" SEWER LINE, COUNTY	5.0'+/-	UNKNOWN
534+48	16" WATER LINE, COUNTY	UNKNOWN	UNKNOWN
534+71	8" N.G. PIPELINE, CITY OF RICHMOND	UNKNOWN	UNKNOWN
563+19	20" SEWER LINE, COUNTY	4.5'	UNKNOWN
565+05	90" R.C.P. CULVERT, STATE OF VA	0.7'	UNKNOWN
571+12	8" PRODUCTS PIPELINE, PLANTATION	4.0'	UNKNOWN
576+93	4" TELE. CONDUIT, C & P	4.5'	A-18A-89-3
577+91	4" ELECTRICAL CONDUIT, V.P.C.	4.5'	UNKNOWN
577+96	4" TELE. CONDUIT, C & P	2.0'	UNKNOWN
578+01	12" WATER LINE, COUNTY	5.9'	UNKNOWN
578+78	TELE. CABLES, C & P	1.5'	UNKNOWN
578+87	5/8" TELE. CABLE, C & P	2.0'	UNKNOWN
580+30	ELECTRICAL CABLE, V.P.C.	3.2'	UNKNOWN
580+43	2" WATER LINE, PRIVATE	2.6'	UNKNOWN
580+58	2" ELECTRICAL CONDUIT, VA POWER	2.0'	UNKNOWN
582+29	2" WATER LINE, PRIVATE	1.9'	UNKNOWN
584+60	ELECTRICAL CABLES, V.P.C.	1.5'	UNKNOWN
584+62	TELE. CABLE, C & P	1.8'	UNKNOWN
585+07	ELECTRICAL CABLES, V.P.C.	0.5'	UNKNOWN
585+19	8" SEWER LINE, COUNTY	5.0'	UNKNOWN
585+50	ELECTRICAL CABLES, V.P.C.	2.5'	UNKNOWN
585+76	TELE. CABLE, C & P	2.0'	UNKNOWN
585+80	CATV CABLE, STORER	2.0'	UNKNOWN
587+95	15" STORM SEWER	UNKNOWN	UNKNOWN
588+13	8" WATEER LINE, COUNTY	4.9'	UNKNOWN
588+58	3" ELECTRICAL CONDUIT, VA POWER	2.0'	A-18A-92-4
590+10	SEWER LINE, COUNTY	UNKNOWN	UNKNOWN
593+17	48" SEWER LINE, COUNTY	1.0'	UNKNOWN
594+00	16" PRODUCTS PIPELINE, COLONIAL	4.0'	UNKNOWN
598+95	4" TELE. CONDUIT, C & P	2.0'	UNKNOWN
599+36	ELECTRICAL CABLES	2.0'	UNKNOWN

D-338.7 SHT 1

STATION	TYPE	COVER	CHNG. DIA
602+05	6" ELECTRICAL CONDUIT, VA POWER	1.5'	A-18A-9
603+02	TELE. CABLE, C & P	2.0'	UNKNOW
605+62	12" WATER LINE, COUNTY	8.0'+/-	UNKNOW
606+04	12" WATER LINE, COUNTY	8.0'+/-	UNKNOW
609+28	2" PVC CASING, VDOT	2.0'	A-18A-9
610+27	2" PVC CASING, VDOT	2.0'	A-18A-9
610+47	TELE. CONDUIT, AT & T	UNKNOWN	UNKNOW
610+66	TELE. CONDUIT, C & P	UNKNOWN	UNKNOW
610+94	8" WATER LINE, COUNTY	UNKNOWN	UNKNOW
611+04	ELECTRICAL CONDUIT, V.P.C.	4.9	UNKNO
611+26	12" N.G. PIPELINE, CITY OF RICHMOND	UNKNOWN	UNKNO
612+15	ELECTRICAL CABLE, V.P.C.	UNKNOWN	UNKNO
612+40	ELECTRICAL CABLE, V.P.C.	0.3'	UNKNO
612+46	ELECTRICAL CABLE, V.P.C.	1.5'	UNKNO
618+33	16" WATER LINE, COUNTY	6.2'	A-18A-9
619+49	4" TELE. CONDUIT, U.S. TELECOM	4.0'	UNKNO
619+91	PVC FIBER OPTIC, QUEST TELECOM	4.0'	A-18A-
620+74	36" SEWER LINE, COUNTY	7.3'	UNKNO
621+10	6" NITROGEN LINE, DUPONT	3.0'	UNKNO
625+34	8" WATER LINE, DUPONT	3.0'	A-18A-9
631+24	4" TELE. CONDUIT, C & P	8.0'	A-18A-
633+43	2" ELECTRICAL CONDUIT, VA POWER	1.5'	A-18A-
651+76	10" ACID LINE, DUPONT	4.0'	UNKNO
651+80	12" ACID LINE, DUPONT	4.0'	UNKNO
651+84	12" ACID LINE, DUPONT	4.0'	UNKNO
651+88	3" ACID LINE, DUPONT	3.6'	UNKNO
651+90	1" ELECTRICAL CONDUIT, DUPONT	2.7'	UNKNO

D-338.9 SHT 1

STATION	TYPE	COVER	CHNG. DIAG. NO.
607+90	CABLE	UNKNOWN	UNKNOWN
612+34	WATER LINE	UNKNOWN	UNKNOWN

D-338.10 SHT 1

STATION	TYPE	COVER	CHNG. DIAG. NO.
671+57	1/2" TELE. CABLE, U.S. TELECOM	4.0'	UNKNOWN
681+73	12" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+40	12" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+42	10" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+44	10" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+46	8" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+48	10" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+49	10" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN
704+51	10" PRODUCTS PIPELINE	UNKNOWN	UNKNOWN

Scheduling for Examination & Remediation

- Utilize industry standards
- Think beyond the regulation
- What makes good sense?
- Code is the **MINIMUM** requirement

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IMP Data Integration, Threat Identification and Risk Models

Jim Hotinger

Data Integration: Hidden in Plain Sight

- Data integration involves gathering of various forms of data, or data elements, from many different sources.
  - One great reference for helping determine data elements to gather that operators are failing to utilize is their own O&M manual.
  - O&M manuals and the procedures within typically contain the records/forms/data being captured during regular operations and maintenance activities.
  - Yet we are finding many of these readily available records are missing from the data integration step of the integrity management plans.

Threat Identification: Going Through the Motions

- ASME/ANSI B31.8S-2004 Section 2.2 lays out the basics of threat identification – it supplies 9 categories covering the 22 total root causes of pipeline incidents, as determined by PRCI (Pipeline Research Committee International).
- Appendix A covers the essentials of applying the prescriptive approach to integrity management plans for the nine categories of threats.
- But where do the unique aspects of your system come into play? Threat identification is one of the most important steps to creating a unique integrity plan that addresses your specific issues.

Threat Identification: Other Potential Threats

- What we’re seeing:
  - The unique threats you identify over time are getting lost in the calculations. They end up being mixed into the general categories already established, resulting in little to no change to the results of risk assessment, and consequently to the implementation of the plan.

Risk Models: Likelihood, Consequence

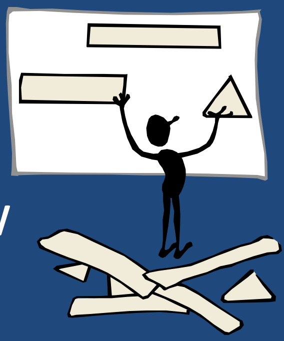
- Everyone involved in Integrity Management and risk models knows the formula:

  Risk = Likelihood x Consequence

- But how do we determine Likelihood? Or Consequence? Are we really considering Consequence, if, for example, we apply the same value for all segments in HCAs? Is that sufficient depth of information gathering to really be considering the consequences of a pipeline incident appropriately?

Periodic Evaluations: Evolving Your Risk Model

- §192.937 (b) requires *periodic* evaluations, *as frequently as needed*, to assure the integrity of covered segments.
  - These evaluations must be based on **data integration** and **risk assessment**
- What this means: your risk model must evolve as new data becomes available, and it must be re-run at regular intervals to ensure you are addressing your highest, current threats.
- What we’ve seen: Operators have not re-run their risk model since the baseline assessment, or not set regular intervals for these evaluations.



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